

ICHTHYOLOGY.—*The blennioid fish genera Cirripectus and Exallias with descriptions of two new species from the tropical Pacific.*¹ DONALD W. STRASBURG, University of Hawaii, and LEONARD P. SCHULTZ, U. S. National Museum.

Schultz (Copeia 1941 (1): 17–20) recognized four species of *Cirripectus*, among which were *C. leopardus* and *C. brevis*. Chapman (*in de Beaufort and Chapman, The fishes of the Indo-Australian Archipelago*, 9: 246–255. 1951) recognized three species of *Cirripectus*: *C. leopardus* (Day), *C. variolosus* (Cuvier and Valenciennes), and *C. sebae* (Cuvier and Valenciennes). In his discussion two extralimital species were recognized, *C. quagga* (Fowler and Ball) and *C. brevis* (Kner).

Further study of these species, based on many additional specimens, indicates conclusively that both Schultz and Chapman misinterpreted Kner's description and figure of *C. brevis*. We now find that *leopardus* must be referred to the synonymy of *brevis* and that the species distinguished by Schultz (i.e., p. 19) as *brevis* is a new species.

This contribution distinguishes as valid the genus *Exallias* and summarizes the chief differences between it and *Cirripectus*. Also two new species are described from the tropical Pacific. We do not consider this study as a review of the genera, since adequate material is not available. We lack specimens from the western Indian Ocean and from several island groups in the tropical Indo-Pacific Oceans.

The following analysis indicates the chief differences between *Cirripectus* and *Exallias*:

- 1a. A pair of barbels on underside of throat, each side of middle of chin; teeth in upper jaw very numerous, fine, flexible, those in lower jaw numerous, moderately flexible, about twice as broad as those in upper jaw and about one-third as many; no canines; least distance between eye and nuchal fringe contained $2\frac{1}{2}$ or more times in postorbital length of head; soft rays of dorsal fin 12 or 13 and anal 14 or 15; upper lip with short barbels. . . . *Exallias* Jordan and Evermann
- 1b. No barbels on underside of head; teeth in both jaws very numerous, fine, flexible, and of approximately same size; one or two canine teeth present at each side of lower jaw; least distance between eye and nuchal fringe contained fewer than two times in postorbital

length of head; soft rays of dorsal 14 to 16 and of anal 15 to 17; upper lip crenulate or nearly so. *Cirripectus* Swainson

Because *Exallias* has been confused with *Cirripectus* since it was proposed, a summary of the nomenclature for the two genera is important as well as that for the single species referable to *Exallias*.

Genus **Exallias** Jordan and Evermann

Exallias Jordan and Evermann, Bull. U. S. Fish Comm. 23 (for 1903): 503. 1905 (type, *Salarias brevis* Kner).

Gloriella Schultz, Copeia 1941(1): 17 (type, *Cirripectes caninus* Herre).

Exallias brevis (Kner)

Salarias brevis Kner, Sitz. Akad. Wiss. Natur. 58: 42, pl. 6, fig. 18. 1868 (type locality, Savaii, Samoa); Weber, *Siboga* Exped. Fische: 537. 1913 (Karakelang Island).

Cirripectes brevis Fowler, Mem. B. P. Bishop Mus. 10: 432. 1928 (Hawaii; Marshall Islands; Kingsmill Islands).

Salarias leopardus Day, Proc. Zool. Soc. London 1869: 518 (type locality, Ceylon).

Blennius leopardus Day, Fishes of India 2: 325, pl. 68, fig. 5. 1876 (Ceylon).

Cirripectes leopardus Schultz, Copeia 1941(1): 19 (Oahu); U. S. Nat. Mus. Bull. 180: 272–273. 1943 (Oahu and Rose Islands); Chapman (*in de Beaufort and Chapman*) Fishes of the Indo-Australian Archipelago 9: 247–249, fig. 43. 1951 (Moluccas, Talaut, Marshalls, Hawaiian and Samoan Islands).

Cirripectes caninus Herre, Philippine Journ. Sci. 59(2): 284. 1936 (type locality, Ternate Island, Moluccas); 70(4): 342. 1939 (Ternate Island).

Gloriella canina Schultz, Copeia 1941(1): 18 (Ternate Island).

Genus **Cirripectus** Swainson

Cirripectus Swainson, Nat. Hist. Fishes 2: 79–80 (*Cirripectes* on pp. 182, 275) 1839 (type, *Salarias variolosus* Cuvier and Valenciennes); Norman, Ann. Mag. Nat. Hist. (11)10: 810. 1943; Chapman, Fishes of the Indo-Australian Archipelago 9: 246. 1951.

Cirripectes Schultz, Copeia 1941(1): 18 (type, *Salarias variolosus* Cuvier and Valenciennes).

During the progress of this study numerous counts and measurements have been made on various species of *Cirripectus* and *Exallias*. These are recorded in Tables 1 to 3 and should be used along with the keys.

¹ Contribution No. 28, Hawaii Marine Laboratory.

Our methods of counting fin rays and the number of cirri need describing. Each fin ray with a separate and distinct base was counted as one ray, those rays split to a single base were also counted as one. Females that are past the *Ophioblennius* stage have the first anal spine embedded in the tissue around the genital region. This spine was evident only by dissection. Sexually mature males have the distal part of the two anal spines developed into a knob, consisting of convoluted spongy tissue.

Each nuchal and supraorbital cirrus, including those forming double rows in certain cases, was counted as one cirrus if it had a single base; thus a cirrus deeply bifurcate distally or near its tip only was counted as one.

The problem of interpreting the significance of a single supraorbital cirrus must be considered on the basis of variability for each species. The supraorbital cirrus of *C. jenningsi* is simple, slender, and very, very rarely slightly bifurcate at its tip. This cirrus is never a broad flap as in certain other species. The supraorbital cirrus of *C. quagga* has a constricted base, thence broadening distally. It may be a simple dermal flap as in many young specimens, or the flap may be bifurcate or with multifid cirri in adults; the potential cirri in this species may appear as fleshy ridges in the dermal flap later becoming separated into distinct cirri.

In the young or juveniles of *C. sebae*, *C. variolosus*, and *C. filamentosus* the supraorbital cirrus occasionally may be simple but in the adults it is usually multifid.

The above discussion indicates that some caution must be used in connection with the supraorbital cirrus for distinguishing certain species. In faded and in young specimens, *jenningsi* and *quagga* may be confused but these two species may be distinguished respectively by the number of times the snout length is contained in the least distance from eye to nuchal fringe, which is 0.7 to 0.8, and 1.0 to 1.3, respectively (see the key).

Cirripectus filamentosus, based on specimens from Arnhem Land, Australia, might be considered as a subspecies of *C. variolosus* on the basis of slightly more numerous rays in dorsal and anal fins and fewer nuchal cirri, if both sexes of adult specimens of *filamentosus* did not possess an elongate first dorsal spine. In *variolosus* only the adult males have an elongate first dorsal spine. We do not have sufficient material from

localities between the Marianas, Marshalls, Phoenix and Samoan Islands, and Australia to study this problem adequately.

The following key does not include the *Ophioblennius* stages of the genera *Cirripectus* and *Exallias*:

KEY TO THE PACIFIC SPECIES OF EXALLIAS AND CIRRIPECTUS

- 1a. Teeth in lower jaw fixed or barely movable and about half as numerous and twice as broad as those in upper jaw; no lower canines; chin with pair of barbels adjoining pair of pores on each side; length of snout into least distance from eye to nuchal fringe 0.3 to 0.5 times; dorsal rays XII, 12 or 13; anal II, 14 or 15 (rarely 15); nuchal cirri 30 to 36 (see table); edge of upper lip with 12 to 24 (usually 18 to 24) barbel-like lappets; color pattern of blackish spots on paler background. *Exallias brevis* (Kner)
- 1b. Teeth in lower jaw freely movable, of about same breadth and number as those in upper jaw; pair of lower canines present; chin without barbels; length of snout into least distance from eye to nuchal fringe 0.7 to 1.3; dorsal rays XII, 13 to 16 (rarely 13); anal II, 14 to 17 (rarely 14); edge of upper lip crenulate. (*Cirripectus* Swainson).
 - 2a. Body and pectoral fins everywhere covered with dark spots on paler background; nuchal cirri 47 to 62; dorsal rays XII, 14; anal II, 15. *Cirripectus fuscoguttatus*, n. sp.
 - 2b. Body and pectoral fins not marked as in 2a; if dark spots are present they do not uniformly cover the body and pectoral fins; nuchal cirri 43 or fewer.
 - 3a. Anterior half of body pale, spotted with darker; posterior half of body blackish, spotted with pale; supraorbital cirrus slender and simple; dorsal rays XII, 15; anal II, 15 or 16 (rarely 15); length of snout into least distance from eye to nuchal fringe 0.7 to 0.8 times.

Cirripectus jenningsi Schultz²
 - 3b. Color pattern not as in 3a.
 - 4a. Color of head and body plain tan to dark brown, sometimes with scattered pale spots or dots on snout, cheeks, and upper lip; fins brown to blackish except sometimes anterodorsal part of spinous and soft dorsals and upper lobe of caudal pale or whitish.
 - 5a. Nuchal cirri totaling 24 to 30 (see table); dorsal rays XII (very rarely XIII), 14 or 15; anal II, 15 or 16; first dorsal spine notably elongate

² *Cirripectes jenningsi* Schultz, U. S. Nat. Mus. Bull. 180: 273-275, fig. 27. 1943 (type locality, Swains Island).

in adults of both sexes as short as 45 mm. standard length.

Cirripectus filamentosus
(Alleyne and Macleay)³

- 5b. Nuchal cirri totaling 29 to 37 (see table); dorsal rays XII, 14; anal II, 14 or 15; first dorsal spine elongate only in adult males.

Cirripectus variolosus
(Cuvier and Valenciennes)⁴

- 4b. Head and body not colored as in 4a.

- 6a. Dorsal rays XII, 13 or 14; anal II, 14 or 15; background coloration light tan to dark brown. *Young*, longitudinal dark stripe from behind eye to caudal fin base, sometimes broken into series of elongate blotches. *Adults*, with 5 to 12 vertical dark brown bars; throat, cheeks, and opercles usually with numerous roundish pale spots, size of pupil, enclosed in reticulated brown lines that resemble a honeycomb, sometimes the brown pigment is so extensive that light spots appear on a dark background.

Cirripectus sebae
(Cuvier and Valenciennes)⁵

- 6b. Dorsal rays XII, 13 to 16 (rarely 13, 14); anal II, 15 to 17 (rarely 15).

- 7a. Head and body tan to dark brown with 8 to 15 vertical dark bars and frequently speckled with tiny black and white dots; narrow dark bar below center of eye, another behind lower rear edge of eye, the latter extending across lip and meeting its fellow on underside of head; narrow transverse dark streak across gill membranes on underside of head; streaks may be diffuse on large specimens; nuchal cirri 25 to 36 (see table); length of snout into least distance from eye nuchal fringe 1.0 to 1.3 times.

Cirripectus quagga
(Fowler and Ball)⁶

- 7b. Head and body dark brown or blackish; no vertical dark bars or streaks near eye or across gill membranes; color pattern consisting of conspicuous roundish pale spots, size of pupil, enclosed in reticulated brown lines that re-

semble a honeycomb, sometimes brown pigment is so extensive that light spots appear on a dark background; this pattern confined to throat, breast and sides of head in males but sometimes extending posteriorly as far as the fifth or sixth soft dorsal ray in females; large males have the posterior half to two-thirds of sides of body with numerous white markings that vary from round white dots or small spots to elongate ones or white lines that extend vertically, obliquely, or horizontally; some of elongate lines may run together; posteriorly both sexes may have scattered pupil-sized blackish spots or short lines on a dark background; nuchal cirri 32 to 42 (see table).

Cirripectus stigmaticus, n. sp.

Cirripectus fuscoguttatus, n. sp.

Fig. 1

Cirripectes brevis (non Kner), Schultz, Copeia 1941(1): 19-20; U. S. Nat. Mus. Bull. 180: 272-273. 1943 (Enderbury and Tutuila Islands); Chapman, Fishes of the Indo-Australian Archipelago 9: 249 (note). 1951.

Holotype.—U.S.N.M. no. 113634. Rongerik Atoll, Eniwetak Island, Ocean reef in surf, June 29, 1946, S-46-241, Schultz and Herald, standard length 68 mm.

Paratypes (lots not bearing U.S.N.M. numbers have been distributed to other museums). —Bikini Atoll, Namu Island, Ocean reef, April 4, S-46-51, Schultz, 5 specimens 42 to 53 mm in standard length; Bikini Atoll, Bokon Island, April 15, S-46-94, Schultz and Brock, 9 specimens 34 to 80 mm; U.S.N.M. no. 142103, Bikini Atoll, Airy Island, April 16, S-46-96, Schultz, 16 specimens, 23.5 to 84 mm; U.S.N.M. no. 142102, Bikini Atoll, Eman Island, July 19, 1947, S-46-441, Schultz, Brock, Myers, and Hiatt, 10 specimens, 19 to 94 mm; Bikini Atoll halfway between Bikini and Amen Islands, July 21, 1947, S-46-442, Brock, Hiatt, and Schultz, 1 specimen; 72 mm; Bikini Atoll, Enyu Island, August 1, 1947, S-46-483, Schultz, Brock, and Hiatt, 2 specimens 73 to 76 mm; Bikini Atoll, Namu Island, August 6, 1947, S-46-508, Schultz, Brock, and Hiatt, 2 specimens, 91 to 95 mm; Bikini Atoll, Bikini Island, August 18, 1947, S-46-533, Brock and Schultz, 2 specimens, 93 to 99 mm; Bikini Atoll, Namu Island, August 7, 1947, S-1019, Brock, Hiatt, and Schultz, 2 specimens, 77 to 92 mm; U.S.N.M. no. 142106,

³ *Salarias filamentosus* Alleyne and Macleay, Proc. Linn. Soc. New South Wales 1: 337, pl. 14, fig. 1. 1877 (type locality, Cape York).

⁴ *Salarias variolosus* Cuvier and Valenciennes, Hist. Nat. Poiss. 11: 317. 1836 (type locality, Guam).

⁵ *Salarias sebae* Cuvier and Valenciennes, Hist. Nat. Poiss. 11: 323. 1836 (type locality, East Indies).

⁶ *Rupiscartes quagga* Fowler and Ball, Proc. Acad. Nat. Sci. Philadelphia 76: 273. 1924 (type locality, Wake Island).

Rongerik Atoll, Eniwetok Island, June 29, S-46-241, Schultz and Herald, 12 specimens, 21 to 81 mm; U.S.N.M. no. 142104, Eniwetok Atoll, Mui Island, May 28, S-46-186, Schultz, 35 specimens, 22 to 100 mm; Eniwetok Atoll, Giriinien Island, May 29, S-46-187, Schultz, 1 specimen, 81 mm; U.S.N.M. no. 142105, Kwajalein Atoll, Ennylabegan Island, September 1, 1946, S-46-397, 1 specimen, 72 mm; U.S.N.M. no. 115497, Tutuila

Island, Fagasa Bay, rock pools, June 5, 1939, Schultz, 1 specimen, 73 mm; U.S.N.M. no. 115498, Enderbury Island, reef, May 15 to 19, 1939, Schultz, 5 specimens, 73 to 89 mm; U.S.N.M. no. 164960, Gilbert Islands, Onotoa Atoll, July–August 1951, lagoon and ocean reefs, Randall and Strasburg, 2 specimens, 60 to 79 mm.

Description.—Certain counts were made of the holotype and paratypes and these data are

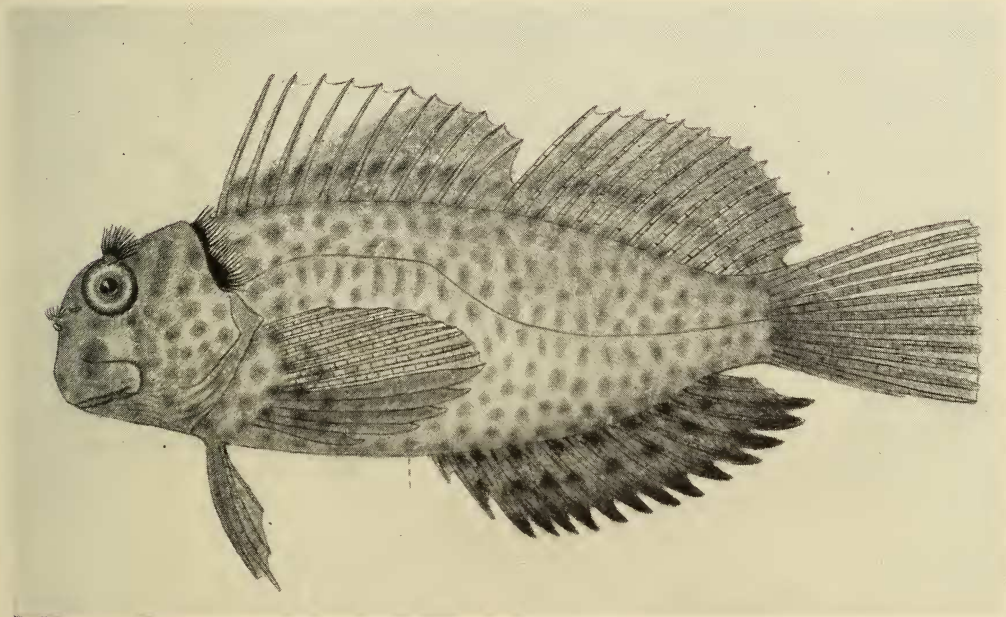


FIG. 1.—*Cirripectus fuscoquittatus*, n. sp.: Holotype (U.S.N.M. no. 113634), 68 mm. in standard length.

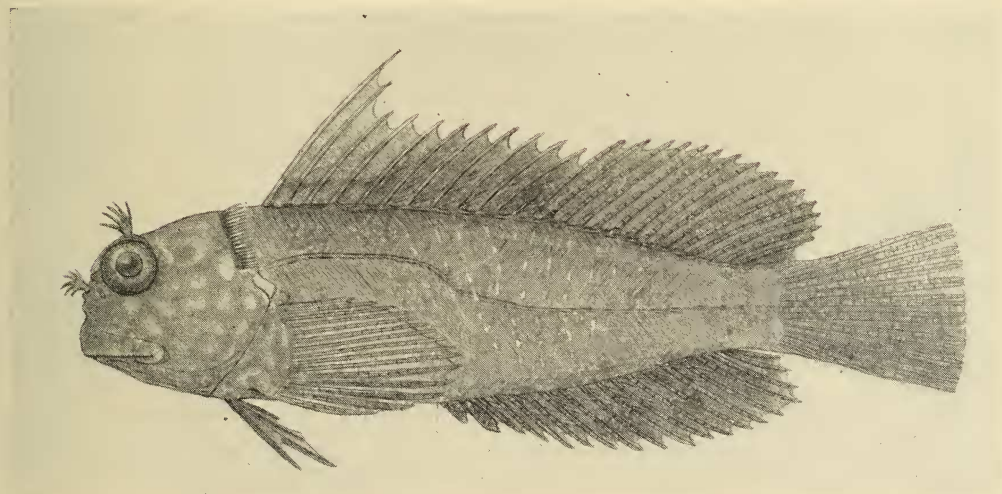


FIG. 2.—*Cirripectus stigmaticus*, n. sp.: Holotype (U.S.N.M. no. 164962), 63 mm. in standard length.

recorded in Table 1. Detailed measurements were made on the holotype, and these data, expressed in thousandths of the standard length, are recorded in Table 2.

Dorsal rays XII, 14; anal II, 15 (first anal spine embedded in females); pectoral 15 (with lower 5 or 6 thickened); pelvics I, 4; branched caudal rays 5 + 4; fringe of cirri on nape 47 to 62; nasal cirri 4 to 12, and orbital cirri 8 to 18 (more cirri on large adults). Head 3.0 to 3.2; greatest depth 3.2 to 3.5; longest dorsal spine 4.8 to 5.7; longest thickened pectoral ray 3.7 to 4.0; all in the standard length. Eye 3.0 to 5.0; snout 2.3 to 2.8; interorbital space 7.0 to 9.0; postorbital length of head 1.6 to 1.7; least depth of body 2.6 to 3.0; greatest depth of body 1.0 to 1.2; preorbital width 4.5 to 6.0; all in length of the head.

Orbital tentacle with a broad flattish base, its distal edge somewhat folded with numerous long cirri, more in adults; nuchal band of cirri simple, those at middorsal line about same length as those laterally, nuchal band of cirri curving posteroventrally so that the distance between vertical lines thru ventrolateral basal tip and anterodorsal edge is contained 4.6 to 5.6 times in postorbital length of head; ventral basal end of nuchal band of cirri blackish, notably swollen even in young, extending ventrally to opposite pupil; snout profile nearly vertical; edge of upper lip with numerous very short papillae or crenulate in young; lower lip shallowly plicate; no cirri on chin; lateral line arched over pectoral fin then curving to midlengthwise axis of body, ending at caudal fin base; a vertical line thru dorsal origin passes just behind lower tip of base of nuchal fringe and just behind pelvic bases; pectoral fin reaches a little past anal origin; anal spines two, first embedded in females, except juveniles; in adult males both anal spines with grayish crenulate and convoluted swollen dermal pads; a canine tooth present on each side of lower jaw; teeth in both jaws very numerous, of equal size, and moveable; sixth pectoral ray from lowermost edge of fin longest; distal edge of caudal fin a little rounded.

Color in alcohol.—Background color brown to light brown; body and head profusely covered with roundish black spots, usually absent from all fins except basally on pectorals; all fins very dark brown or blackish. The color pattern changes with size as follows: From 19 to 30 mm in standard length the black spots are barely discernible and few in number, the background color is

chiefly plain brownish and dark and light bands on the head are becoming developed. In those 30 to 40 mm there is a prominent V-shaped brown mark on front of snout, which is separated by a narrow white band from next black band extending from below eye across upper lip to meet its fellow on chin, there forming a triangular spot; just behind this is a wide white band extending from behind eye across cheek through rear of maxillary meeting its fellow under head; this pale band set off sharply by dark brown color of rear of head. From 40 to 55 mm the large black spots on head and body are prominent, and the pale and dark bands on head are still discernible. Between the lengths of 55 to 70 mm, the black bands on head begin to break up into dark spots, and in those longer than 70 mm, the bands are no longer distinct having broken into roundish to oblong spots.

The nuchal fringe consists of black cirri, with a very blackish swollen basal area at lateral tips, even in the 19 mm specimen; the two anal spines on adult males have swollen dermal pads light grayish in color.

Color when alive.—Background color dark brown, spots blackish; eye crimson (iris); upper edge of caudal fin orange.

Ecology.—This moderately common species was taken in the Lithothamnium ridge area where the surf was strong.

Remarks.—The statement by Chapman (l.c., p. 249) that the two species "*leopardus*" and "*brevis*" (now *fuscoguttatus*) occur side by side in the Marshalls, Hawaii, and Samoa is incorrect. *C. fuscoguttatus* has not been collected in the Hawaiian Islands or at Johnston Island.

The key to the species of *Cirripectus* gives the essential characters and distinguishes *fuscoguttatus* from other related species in the genus.

Named *fuscoguttatus* in reference to the profusion of brown spots on body and fins.

Cirripectus stigmaticus, n. sp.

Fig. 2

Holotype.—U.S.N.M. no. 164962, Rongerik Atoll, Latoback Island, lagoon reef, June 28, 1946, S-46-238, Schultz and Herald, male, standard length 63 mm.

Paratypes.—U.S.N.M. no. 164963, Rongerik Atoll, Latoback Island, lagoon reef, June 28, 1946, S-46-238, Schultz and Herald, 2 specimens, 62 and 66 mm; U.S.N.M. no. 164964, Bikini Atoll, lagoon reef half way between Bikini and Amen Islands, July 21, 1947, S-46-442, Brock,

TABLE 1.—COUNTS RECORDED FOR SPECIES OF *Cirripectus* AND *Exallias* FROM THE MARSHALL, GILBERT, PHOENIX, AND SAMOAN ISLANDS.

[illegible]

1 These data include counts made on 15 specimens from Johnston Island and the Hawaiian Islands.

² All counts made on specimens from Arnhem Land, northern Australia.

³ Not taken in the Marshall Islands.

⁴Two specimens from Wake Island included in the counts.

TABLE 2.—THE LENGTH OF THE SNOUT INTO THE
LEAST DISTANCE BETWEEN HINDBORDER OF
EYE AND NUCHAL FRINGE

Genus and species	Ratio											
	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	
<i>Exallias brevis</i>	2	10	1									
<i>Cirripectus:</i>												
<i>fuscoguttatus</i> , n.												
sp.....					6	3		1				
<i>variolosus</i>							2	8	2			
<i>sebae</i>								10	2	1		
<i>filamentosus</i>								5	2	1		
<i>jenningsi</i>					4	5						
<i>quagga</i>								1	3	2	1	
<i>stigmaticus</i> , n.												
sp.....						2	6	2	1			

TABLE 3.—MEASUREMENTS, EXPRESSED IN THOU-
SANDTHS OF THE STANDARD LENGTH, MADE
ON CERTAIN SPECIES OF CIRRIPECTUS

Characters	C. stigmaticus, n. sp.			C. fuscoguttatus, n. sp.		
	Holo- type	Para- type	Para- type	Holo- type	Para- type	Para- type
Standard length in mil- limeters.....	63.0	43.1	93.0	68	22	81
Head, tip of snout to rear of opercular membrane.....	291	309	291	316	332	321
Greatest depth of body.....	307	320	333	360	282	348
Least depth of body....	113	114	116	129	109	123
Postorbital length of head.....	190	188	185	201	159	198
Diameter of eye.....	75	88	62	76	114	72
Snout tip or front of up- per lip to eye.....	105	130	96	154	127	142
Fleshy interorbital space.....	30	23		37	41	37
Least distance from eye to nuchal fringe.....	114	97	104	106	109	107
Longest dorsal spine....	289	241	190	210	154	216
Longest soft dorsal ray.....	217	218	202	225	173	216
Longest soft anal ray...	156	144	165	206	141	183
Longest pectoral ray....	252	262	215	313	259	284
Longest pelvic ray.....	181	200	174	235	218	198
Longest caudal ray.....	268	278	258	294	273	289
Snout tip to anus.....	510	534	556	486	559	518
Snout tip to dorsal ori- gin.....	321	320	303	332	336	333
Length of anal fin base..	413	410	468	404	382	251
Sex.....	♂	♂	♀	♀	—	♂

Hiatt, and Schultz, 2 specimens, 93 and 99.5 mm; U.S.N.M. no. 142129, Rongerik Atoll, Latoback Island, lagoon reef, August 14, 1947, Brock, Schultz, and Donaldson, 1 specimen, 82 mm; U.S.N.M. no. 164965, Apia, Samoa, Jordan and Kellogg, 1 specimen, 66.5 mm; U.S.N.M. no. 164961, Gilbert Islands, Onotoa Atoll, lagoon and ocean reefs, July–August 1951, John E. Randall and Donald W. Strasburg, 16 specimens, 36 to 76 mm; U.S.N.M. no. 154674, Marshall Islands, Arno Atoll, lagoon reef, June–September 1950, Donald W. Strasburg and Robert W. Hiatt, 3 specimens, 67 to 81 mm; U.S.N.M. no. 154673, Marshall Islands, Arno Atoll, ocean reef, June–September 1950, Donald W. Strasburg and Robert W. Hiatt, 2 specimens, 45 to 56 mm.

Description.—Certain counts are recorded in Table 1. Detailed measurements were made on the holotype and two paratypes, and these data are expressed in thousandths of the standard length in Table 3.

Dorsal rays XII, 14 to 16, rarely 14 or 16; anal II, 15 or 16, rarely 15 (first anal spine embedded on females); pectoral 14 to 16, rarely 14 or 16 (with lower 5 or 6 thickened); pelvics I, 4; branched caudal rays 5 + 4; fringe of cirri on nape 32 to 42, generally 35 to 42; nasal cirri 4 to 6; supraorbital cirri 4 to 10 (more cirri on large adults).

Head 2.9 to 3.1; greatest depth 3.1 to 3.3; longest dorsal spine (first) 1.9 to 2.9 (the first dorsal spine is elongate in adult males); longest thickened pectoral ray 2.1 to 2.6; all in the standard length. Eye 3.5 to 4.7; snout 2.4 to 3.1; interorbital space 7.7 to 13.3; postorbital length of head 1.5 to 1.7; least depth of body 2.5 to 3.0; greatest depth of body 0.87 to 0.96; all in the length of the head.

Orbital tentacle with a broad flattened base, its distal edge with numerous long cirri, more in adults; nuchal band of cirri simple, those at mid-dorsal line about same length as those laterally, nuchal band of cirri curving posteroventrally so that the distance between vertical lines through ventrolateral basal tip and anterodorsal edge is contained 4.6 to 6.5 times in postorbital length of head; ventral basal end of nuchal band of cirri is notably swollen and flattened even in young; it is blackish and bears the lowermost 8 or 9 cirri, and extends ventrally to about upper edge of pupil; snout profile nearly vertical; edge of upper lip with numerous short papillae or crenulate in young; lower lip with mesial third smooth,

lateral third on each side somewhat plicate; no cirri on chin; lateral line arched over pectoral fin then curving to midlengthwise axis of body, ending at caudal fin base; vertical line through dorsal origin passes just behind ventral tip of nuchal fringe base and just behind pelvic bases; pectoral fin reaches a little past anal origin; anal spines two, first embedded on females past the *Ophioblennius* stage, both free on males; adult males have crenulate and convoluted spongy masses on these spines; a canine tooth present on each side of lower jaw; teeth in both jaws very numerous, of about equal size in both jaws, and movable; fifth or sixth pectoral ray from lowermost edge of fin longest; distal edge of caudal fin a little rounded.

Color in alcohol.—Background color brown to blackish; vertical fins dark and unmarked except for anterodorsal part of the spinous dorsal, the distal tips of the first few soft dorsal rays, and the upper lobe of the caudal which may be pale or whitish; anal somewhat darker than body or other fins, pelvics dusky, pectorals dusky ventrally, paler dorsally.

The color pattern changes with size as follows: The smallest specimen available (35.8 mm in standard length) has the background color brown with the cheeks, opercles and sides of the body posteriorly to the tip of the depressed pectoral overlaid with round pale spots about the size of the pupil. Posterior to the pectoral tips these spots are enlarged so much that the surrounding brown areas have the appearance of irregular lines on a pale background. The vertical fins of this specimen are pale brown basally becoming almost transparent in their distal half to two-thirds. The spinous dorsal is marked with a dusky lengthwise stripe along its basal third; this demarks the distal pale area mentioned above.

In specimens above 40 mm in standard length the characteristic, although somewhat variable, adult color pattern has been attained. The roundish pupil-sized pale spots are much more distinct, sometimes they are enclosed in reticulated brown lines that resemble a honeycomb, and sometimes the brown pigment is so extensive that the spots appear to be on a dark background. The nuchal fringe consists of black cirri with a swollen, very blackish basal area laterally.

The distribution of the spots and other markings varies with sex as follows: *Males*: Spots on preorbitals and suborbitals, cheeks, opercles, entire under side of head and throat, and extending

posteriorly on the pectoral bases. The posterior one-half to two-thirds of the sides of the body are covered with numerous white markings that may vary from round white dots or small spots to elongate ones or white lines that extend vertically, horizontally or obliquely; some of these lines may run together. There may be a few blackish pupil-sized dots or irregular markings on the sides of the caudal peduncle. The dermal pads on the anal spines of males are grayish to blackish in color. *Females*: Pale spots as in males; in addition they may extend as far posteriorly as the fifth or sixth dorsal soft ray. Posterior to this the spots give way to plain dark color or there may be irregular blackish dots or short lines on a dark background.

Color when alive.—Background color brown to blackish, anterior spots pale brown, sides of males covered with bright red dots or elongate spots or lines; anterodorsal tip of first and second dorsals and upper lobe of caudal reddish orange to white.

Ecology.—This rather uncommon species was taken in the Lithothamnium ridge area or areas of *Acropora* and *Pocillopora* corals where the surf was moderate to strong.

Remarks.—The key to the species *Cirripectus stigmaticus* from all related species in the genus.

Named *stigmaticus* in reference to the white and dark spots.

Obituaries

PAUL ARDEEN NEAL, medical director, United States Public Health Service, died on October 13, 1952, after a brief illness.

Dr. Neal, who was chief of the Laboratory of Physical Biology in the National Institutes of Health at the time of his death, entered the Public Health Service immediately after obtaining his medical degree from Vanderbilt University in 1927. He interned in U. S. Marine Hospital at New Orleans; received his Commission in the Service June 30, 1928; and during the following year was assigned to the Marine Hospital at Mobile, Ala.

From 1929 to 1933 Dr. Neal was attached to various United States Consulates abroad, in Ireland, Germany, Poland, Denmark, and Italy. He began his research career when, in 1934, he was assigned to the Division of Scientific Research to serve under Dr. R. R. Sayers in the Office of Industrial Hygiene and Sanitation. This marked the beginning of his active interest in the study of industrial poisons.

At the time the Division of Scientific Research was merged with the National Institute of Health (February 1, 1937), the Office of Industrial Hygiene became the Division of Industrial Hygiene, and Dr. Neal was placed in charge of the research laboratory of the division. When this laboratory became a separate organization within the National Institutes of Health, he continued as chief of the Laboratory of Physical Biology, the position he occupied until his death.

Dr. Neal was noted for his contributions to the field of industrial hygiene and was particularly

interested in the fundamental processes involved in toxicology. Specific studies in mercury, manganese, and DDT poisoning were of critical importance to him. He was frequently called on by defense organizations and industry for consultation and assistance. In connection with the Model Safety Code for Industrial Establishments which was being prepared by the International Labor Office, Dr. Neal went to Geneva in the spring of 1949. In this year he was certified as specialist in Preventive Medicine and Public Health (Founders' Group) by the American Board of Preventive Medicine and Public Health. He was also a member of the Joint Subcommittee on Toxicity Screening Methods of the National Research Council Food Protection Committee, Subcommittee on Toxicology, and the Manufacturing Chemists' Association Committee on Chemicals in Foods.

Under Dr. Neal's direction the Laboratory of Physical Biology broadened its attack on fundamental biological problems to research in molecular biophysics, low energy and nuclear radiation biology, and physiological physics. He was author or joint author of more than 100 scientific articles.

He was a member of many scientific societies, notably the American Medical Association, American Public Health Association, American Association for the Advancement of Science, Washington Academy of Sciences, Association of Military Surgeons, American Industrial Hygiene Association, American Statistical Association, American Society of Human Genetics, and Society of Sigma Xi.